CITY OF LODI

REPORT ON WATER QUALITY RELATIVE TO PUBLIC HEALTH GOALS JUNE, 2007

Background

Provisions of the California Health and Safety Code, Title 22, Section 116470, specify that larger water utilities (more than 10,000 service connections), are required to prepare a special report every three years detailing if their water quality measurements have exceeded any Public Health goals (PHGs). These are non-enforceable goals established by the Cal-EPA's Office of Environmental Health Hazard Assessment. As of January 1, 2007 Cal-EPA has adopted 93 PHGs. The law also requires that where Cal-EPA has not adopted a PHG for a constituent, the water suppliers are to use the enforceable Maximum Contaminant Level Goals (MCLGs) adopted by the United States Environmental Protection Agency (U.S. EPA). Only constituents which have a California primary drinking water standard and for which either a PHG or MCLG has been set are to be addressed per regulations.

The law specifies what information is to be provided in the report. If a constituent was detected in the water supply at a level exceeding an applicable PHG or MCLG, this report provides the information required by law. Included are:

- The numerical public health risk associated with the Maximum Contaminant Level (MCL) and the PHG or MCLG;
- The category or type of risk to health that could be associated with each constituent;
- The best treatment technology available that could be used to reduce the constituent level;
- An estimate of the cost to install that treatment if it is appropriate and feasible.

What are PHGs?

PHGs are Public Health Goals set by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment and are based solely on public health risk considerations. None of the practical risk-management factors that are considered by the U.S. EPA or the California Department of Health Services in setting enforceable drinking water standards (Maximum Contaminant Levels or MCLs) are considered in setting the PHGs. These factors include analytical detection capability, treatment technology available, benefits and costs. The PHGs are not enforceable and are not required to be met by any public water system. MCLGs are the federal equivalent to PHGs.

Water Quality Data Considered:

All of the water quality data collected by our water system in 2004 - 2006 for purposes of determining compliance with drinking water standards was considered. In the attached 2006 Annual Water Quality Report which was mailed to our customers in April 2007, only data

from 2006 was summarized. The attached 2006 Annual Water Quality Report also contains useful definitions for PHG, MCLG, MCL, microgram per liter, and milligram per liter.

Guidelines Followed:

The Association of California Water Agencies prepared guidelines for water utilities to use in preparing these required reports, and these guidelines were used in the preparation of our report. No guidance was available from state regulatory agencies.

Best Available Treatment Technology and Cost Estimates:

Both the U.S. EPA and the California Department of Health Services adopt what are known as Best Available Technologies or BATs which are the best known methods of reducing contaminant levels to the MCL. Costs can be estimated for such technologies. However, since many PHGs and all MCLGs are set much lower than the MCL, it is not always possible, nor feasible to determine what treatment is needed to further reduce a constituent downward to or near the PHG or MCLG, many of which are set at zero. Estimating the costs to reduce a constituent to zero is difficult, if not impossible, because it is not possible to verify by analytical means that the level has been lowered to a zero. In some cases, installing treatment to try and further reduce very low levels of one constituent may have adverse effects on other aspects of water quality. For example; to meet the Copper PHG, chemicals to further coat home plumbing would need to be added to Lodi's drinking water, and in GAC treatment systems, more frequent change outs of carbon and larger vessels keeping water in contact with activated carbon longer can both increase the risk of bacterial contamination.

The estimates below reflect only wellhead treatment capital and annual operation and maintenance costs for typical wells. Design, potential costs for additional land and other site specific requirements are not included, thus the potential costs are understated. These costs are not indicative of the total past and potential future costs to remediate groundwater throughout Lodi.

Constituents Detected That Exceed a PHG or a MCLG:

The following is a discussion of constituents that were detected in one or more of our drinking water sources at levels above the PHG, or if no PHG, above the MCLG.

Trichloroethylene (TCE): The PHG for TCE is 0.8 micrograms per liter (ug/L or parts per billion). The MCL or drinking water standard for TCE is 5 ug/L. We detected TCE at levels not exceeding the MCL in the discharges from 1 of Lodi's 25 City Wells used in 2006. The average for this City Well in 2004-06 was:

City Well No. 2 - 1.4 ug/L

The category of health risk associated with TCE, and the reason that a drinking water standard was adopted for it, is the people who drink water containing TCE above the MCL throughout their lifetime could theoretically experience an increased risk of getting cancer. The California Department of Health Services says that "Drinking water which meets this standard

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(the MCL) is associated with little to none of this risk and should be considered safe with respect to TCE." (*CDHS Blue Book of drinking water law and regulations, Section 64468.2, Title 22, CCR.*) The Best Available Technology for TCE to lower the level below the MCL is either Granular Activated Carbon or Packed Tower Aeration. Since the TCE level in these two City Wells is already below the MCL, a Granular Activated Carbon Treatment System with larger vessels would likely be required to attempt to keep TCE levels to below 0.8 ug/L. The estimated cost to install such a treatment system on one City Well and enhance the capacity on one City Well with an existing treatment system that would reliably reduce the TCE level to below 0.8 ug/L would be approximately $450,000 and require annual Operation and Maintenance at a cost of approximately $5 per year. This would result in an assumed increased cost for each customer of approximately $5 per year*.

Dibromochloropropane (DBCP): The PHG for DBCP is 1.7 nanograms per liter (ng/L or parts per trillion). The MCL for DBCP is 200 ng/L. We detected DBCP at levels not exceeding the MCL in the discharges from thirteen of Lodi's 25 City Wells used in 2006. City Well No. 8 was not used in 2006, but could be used if treatment were installed and is included as a fourteenth City Well below in cost calculations. The averages for these City Wells in 2004-06 were:

City Well No. 1R	-	89 ng/L
City Well No. 4R	-	39 ng/L
City Well No. 6R	-	160 ng/L
City Well No. 8	-	252 ng/L
City Well No. 13	-	81 ng/L
City Well No. 14	-	84 ng/L
City Well No. 16	-	13 ng/L
City Well No. 17	-	180 ng/L
City Well No. 18	-	35 ng/L
City Well No. 19	-	110 ng/L
City Well No. 20	-	46 ng/L
City Well No. 21	-	4 ng/L
City Well No. 22	-	22 ng/L
City Well No. 23	-	40 ng/L

The category for health risk associated with DBCP, and the reason that a drinking water standard was adopted for it, is the people who drink water containing DBCP above the MCL throughout their lifetime could theoretically experience an increased risk of getting cancer. The California Department of Health Services says that "Drinking water which meets this standard (the MCL) is associated with little to none of this risk and should be considered safe with respect to DBCP." *(CDHS Blue Book of drinking water law and regulations, Section 64468.3, Title 22, CCR.)* The numerical health risk for an MCLG of zero is zero. The Best Available Technology for DBCP to lower the level below the MCL is either Granular Activated Carbon or Packed Tower Aeration. To attempt to maintain the DBCP levels at

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zero, Granular Activated Carbon Treatment Systems with longer empty bed contact times and more frequent carbon change-outs would likely be required. The estimated cost to install such a treatment system on eight City Wells, and enhance capacities on six City Wells with existing treatment systems that would reliably reduce the DBCP level to zero would be approximately $3.2 million. The increased annual Operation and Maintenance costs would be approximately $480,000 per year. This would result in an assumed increased cost for each customer of approximately $34 per year*. (Note: this increase cost may not be reimbursable under the terms of Lodi's settlement agreement with DBCP manufacturers.)

1,1,2,2- Tetrachloroethylene (PCE) : The PHG for PCE is 0.06 micrograms per liter (ug/L or parts per billion). The MCL or drinking water standard for PCE is 5 ug/L. We detected PCE at levels not exceeding the MCL in the discharges from two (2) of Lodi's 25 City Wells used in 2006. City Well No. 8 was not used in 2006, but could be used if treatment were installed and is included as a third City Well below in cost calculations. The averages of these City Wells in 2004 -06 were:

City Well No. 6R	-	1.08 ug/L
City Well No. 8	-	0.82 ug/L
City Well No. 12	-	0.26 ug/L

The category of health risk associated with PCE, and the reason that a drinking water standard was adopted for it, is the people who drink water containing PCE above the MCL throughout their lifetime could theoretically experience an increased risk of getting cancer. The California Department of Health Services says that "Drinking water which meets this standard (the MCL) is associated with little to none of this risk and should be considered safe with respect to PCE." (*CDHS Blue Book of drinking water law and regulations, Section 64468.2, Title 22, CCR.*) The Best Available Technology for PCE to lower the level below the MCL is either Granular Activated Carbon or Packed Tower Aeration. Since the PCE level in these three City Wells is already below the MCL, a Granular Activated Carbon Treatment System with larger vessels would likely be required to attempt to keep PCE levels below the PHG. The estimated cost to install such a treatment system on three City Wells that would reliably reduce the PCE level to the PHG of 0.6 ug/L would be approximately $1,350,000 and require annual Operation and Maintenance at a cost of approximately $164,000 per year. This would result in an assumed increased cost for each customer of approximately $13 per year*.

Coliform Bacteria: In 2004-06, we collected 3,189 samples from our distribution system for coliform analysis. Of these samples, 0.75% were positive for coliform bacteria. In 2004-06 a maximum of 6.9% (January 2004) of these samples were positive for one month.

The MCL for coliform is 5% positive samples of all samples per month and the MCLG is zero. The reason for the coliform drinking water standard is to minimize the possibility of the water containing pathogens which are organisms that cause waterborne disease. Because coliform is only an indicator of the potential presence of pathogens, it is not possible to state a specific numerical health risk. While U.S. EPA normally sets MCLGs "at a level where no

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known or anticipated adverse effects on persons would occur" they indicate that they cannot do so with coliforms.

Coliform bacteria are organisms that are found just about everywhere in nature and are not generally considered harmful. They are used as an indicator because of the ease in monitoring and analysis. If a positive sample is found, it indicates a potential problem that needs to be investigated and follow up sampling done. It is not at all unusual for a system to have an occasional positive sample. It is difficult, if not impossible, to assure that a system will never get a positive sample. A further test that is performed on all total coliform positive results is for Fecal Coliform or E. Coli. There were no positive Fecal Coliform or E. Coli results in 2004-06.

To reduce the number of positive results for coliform bacteria, the City of Lodi occasionally chlorinates the water system. The sources of water (City Wells) and all new or repaired water mains follow disinfection procedures and pass bacteriological testing before being allowed "on-line".

Full time chlorination will not guarantee that a system will never get a positive sample. If the City were to go to full time chlorination of the drinking water system, the estimated cost to install chlorine generation systems on twenty-six City Wells would be approximately $1,035,000 and annual Operation and Maintenance cost would be approximately $65,000 per year. This would result in an assumed increased cost for each customer of approximately $7 per year.*

Copper: The PHG for copper is 0.17 milligrams per liter (mg/L or parts per million). There is no MCL for Copper. Instead the 90th percentile value of all samples from household taps in the distribution system cannot exceed an Action Level of 1.3 mg/L.

The category of health risk for copper is gastrointestinal irritation.

All of Lodi's source water samples for copper in 2004-06 were less than the PHG. Based on sampling of the distribution system in 2006, our 90th percentile value for copper was 0.32 mg/L.

Our water system is in full compliance with the Federal and State Lead and Copper Rule. Based on sampling, it was determined, based on State regulatory requirements, that Lodi meets the Action Level for copper. Therefore, based on criteria set forth by the California Department of Health Services we meet the criteria for "optimized corrosion control" for our system.

In general, optimizing corrosion control is considered to be the best available technology to deal with corrosion issues and with any copper findings. We continue to monitor our water quality parameters that relate to corrosivity, such as the pH, hardness, alkalinity, total

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dissolved solids, and will take action if necessary to maintain our system in an "optimized corrosion control" condition.

Since we are meeting the "optimized corrosion control" requirements, there is no apparent reason to initiate additional corrosion control treatment as it involves the addition of other chemicals and there could be additional water quality issues raised. Therefore, no estimate of cost has been included.

Arsenic: The PHG for Arsenic is 0.004 micrograms per Liter (ug/L or parts per billion). The MCL, or drinking water standard for arsenic is 10 ug/L. There were arsenic levels detected at levels not exceeding the MCL in discharges from 25 of Lodi's 26 wells used in 2004-06. The average of these wells in 2004-06 were:

City Well No. 1R	-	6.0 ug/L
City Well No. 2	-	3.1 ug/L
City Well No. 3R	-	5.4 ug/L
City Well No. 4R	-	3.9 ug/L
City Well No. 5	-	5.1 ug/L
City Well No. 6R	-	3.7 ug/L
City Well No. 7	-	5.0 ug/L
City Well No. 8	-	2.2 ug/L
City Well No. 9	-	2.7 ug/L
City Well No. 10	-	2.7 ug/L
City Well No. 11	-	5.2 ug/L
City Well No. 13	-	8.8 ug/L
City Well No. 14	-	4.1 ug/L
City Well No. 15	-	5.1 ug/L
City Well No. 16	-	3.4 ug/L
City Well No. 17	-	4.1 ug/L
City Well No. 18	-	2.7 ug/L
City Well No. 19	-	3.2 ug/L
City Well No. 20	-	3.5 ug/L
City Well No. 21	-	3.3 ug/L
City Well No. 22	-	2.4 ug/L
City Well No. 23	-	3.8 ug/L
City Well No. 24	-	6.6 ug/L
City Well No. 25	-	6.8 ug/L
City Well No. 26	-	9.7 ug/L

Arsenic is a naturally occurring element found in many types of rocks and soils. Leaching of these deposits are the primary source of arsenic found in this area. Some people who drink water containing arsenic in excess of the MCL over many years may experience skin damage

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or circulatory system problems, and may have an increased risk of getting cancer. The PHG of 0.004 ug/L for arsenic is far below the Detection Limit Requirement (DLR) of 2 ug/L for arsenic. The DLR is the level that can be reliably determined by current laboratory methods.

The Best Available Treatment (BAT) for arsenic removal is dependant on the water chemistry of the source to be treated. While research into new methods of removing arsenic continues, the current recommendations include:

- Activated Alumina
- Coagulation / Filtration
- Lime Softening
- Reverse Osmosis

All of the above listed methods take space, are expensive, and have a concentrated residual, which requires safe disposal. An estimate of the best approach for arsenic removal in Lodi cannot be made at this time.

Radium-228: The PHG for radium-228 is 0.019 picocuries per liter (pCi/L). There is no MCL, or drinking water standard for radium-228. There were radium-228 levels detected in discharges from 17 of Lodi's 26 City Wells used in 2004-06. The average of these wells in 2004-06 were:

City Well No.	1R	-	0.211 pCi/l
City Well No.	2	-	0.012 pCi/l
City Well No.	3R	-	0.075 pCi/l
City Well No.	6R	-	0.231 pCi/l
City Well No.	8	-	0.176 pCi/l
City Well No.	10	-	0.319 pCi/l
City Well No.	12	-	0.041 pCi/l
City Well No.	14	-	0.211 pCi/l
City Well No.	15	-	0.172 pCi/l
City Well No.	16	-	0.115 pCi/l
City Well No.	17	-	0.456 pCi/l
City Well No.	19	-	0.326 pCi/l
City Well No.	21	-	0.240 pCi/l
City Well No.	22	-	0.373 pCi/l
City Well No.	24	-	0.413 pCi/l
City Well No.	25	-	0.142 pCi/l
City Well No.	26	-	0.041 pCi/l

The California Department of Health Services (CDHS), which sets drinking water standards, has determined that total radium is a health concern at certain levels of exposure. This radiological constituent is a naturally occurring contaminant in some groundwater and surface water supplies. This constituent has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Constituents

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that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed over long periods of time.

The Best Available Technology identified to treat the removal of the radiological constituents listed above is reverse osmosis (RO) treatment. The most effective and economical treatment system is to use RO treatment at select plant sites. The estimated cost to install such a treatment system on seventeen City Wells that would reliably reduce the Radium-228 level to the PHG of 0.019 pCi/L would be approximately $20,000,000 and require annual Operation and Maintenance at a cost of approximately $850,000 per year. This would result in an assumed increased cost for each customer of approximately $125 per year*.

Uranium: The PHG for Uranium is 0.43 picocuries per liter (pCi/L). The MCL or drinking water standard for Uranium is 20 pCi/L. There were Uranium levels detected at levels not exceeding the MCL in discharges from 16 of Lodi's 26 City wells used in 2004-06. The average of these wells in 2004-06 were:

City Well No.	2	-	2.79	pCi/l
City Well No.	4R	-	0.310	pCi/l
City Well No.	6R	-	4.66	pCi/l
City Well No.	8	-	10.9	pCi/l
City Well No.	9	-	2.42	pCi/l
City Well No.	10C	-	0.942	pCi/l
City Well No.	12	-	15.8	pCi/l
City Well No.	13	-	2.34	pCi/l
City Well No.	14	-	2.48	pCi/l
City Well No.	16	-	2.10	pCi/l
City Well No.	17	-	5.34	pCi/l
City Well No.	18	-	8.24	pCi/l
City Well No.	19	-	1.09	pCi/l
City Well No.	20	-	1.22	pCi/l
City Well No.	22	-	4.07	pCi/l
City Well No.	23	-	8.14	pCi/l

The California Department of Health Services (CDHS), which sets drinking water standards, has determined that total Uranium is a health concern at certain levels of exposure. This radiological constituent is a naturally occurring contaminant in some groundwater and surface water supplies. This constituent has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Constituents that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed over long periods of time.

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The Best Available Technologies (BATs) for removal of Uranium from drinking water are: Ion Exchange - Reverse Osmosis or Lime Softening. These methods are expensive and require disposal of a waste stream, which would contain concentrated radionucleotides. The estimated cost to install such a treatment system on fifteen City Wells that would reliably reduce the Uranium level to the PHG of 0.43 pCi/L would be approximately $18,000,000 and require annual Operation and Maintenance at a cost of approximately $750,000 per year. This would result in an assumed increased cost for each customer of approximately $110 per year*.

Recommendations For Further Action:

The drinking water quality of the City of Lodi Public Water System meets all State of California, Department of Health Services and U.S. EPA drinking water standards set to protect public health. To further reduce the levels of the constituent's identified in this report that are already below the Maximum Contaminant Levels established by the State and Federal government, additional costly treatment processes would be required.

The effectiveness of the treatment processes to provide any significant reductions in constituent levels at these already low values is uncertain. The theoretical health protection benefits of these further hypothetical reductions are not at all clear and may not be quantifiable. Therefore, staff is not recommending further action at this time. However, the point of this process is to provide you with information on water quality in Lodi and rough costs to make certain improvements.

This report was completed by City of Lodi Public Works Department staff. Any questions relating to this report should be directed to: City of Lodi, Water/Wastewater Superintendent Frank Beeler, 1331 South Ham Lane, Lodi, CA 95242 or call (209) 333-6740.

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